CHROMOSOME NUMBERS OF SOME JAPANESE RHOPALOCERA

by KODO MAEKI and SAJIRO MAKINO

The order Lepidoptera has long furnished favorite material for cytological study, and extensive studies of the chromosomes have been carried out, mainly from the cyto-taxonomic standpoint. With reference to the list of the chromosome numbers in animals, published by MAKINO (1951), it is evident that the list of the known chromosomes in the Heterocera, or moths, including about 170 species, is larger than for the Rhopalocera, of which about 150 species are known. So far as the authors are aware, the comparative studies of the chromosomes have been published by BELIAJEFF (1930), FEDERLEY (1938), LORKOVIC (1941), and some others, mainly with European butterflies. Our knowledge of the chromosomes of Japanese butterflies, however, is very meager. In view of this the present authors have undertaken the chromosome study of Japanese species of butterflies since 1951, to contribute something in this unexplored field, and made clear the chromosome numbers of 52 species of butterflies which were mostly obtained in the vicinity of Sapporo, Hokkaido. This report seems to furnish the first comparative study which deals with butterfly chromosomes in Japan.

All the butterflies used as material for the present study were collected during 1951 and 1952. They belong to seven families. They include 52 species of the Rhopalocera, namely: 1 species of Libytheidae, 7 species of Lycaenidae, 21 species of Nymphalidae, 5 species of Papilionidae, 7 species of Pieridae, 8 species of Satyridae, and 3 species of Hesperiidae. In most cases, the testes obtained from mature adults were used in this study. For the fixatives, Allen's P. F. A.-3 solution, Allen-Bouin's mixture, Allen's B-3 solution, and Benda's fluid were employed. The sections were made according to the paraffin method and stained with Heidenhain's iron-haematoxylin with a counter-stain of light green.

In all species studied here, the spermatogonial chromosomes were not observed. The haploid chromosomes in both primary and secondary spermatocytes came under study. It is notable that the chromosome number of *Pieris melete* shows a variation ranging from 27 to 31. The basic number was determined as 27. The cause of the numerical variation lies in the presence of supernumerary chromosomes. The supernumeraries vary from 1 to 4, each represented by a minute element. The species coming under study and the chromosome numbers established are listed in the table. The species having numbers around 30 (n) are most numerous, being 73% in frequency. The chromosome number of the species studied ranges from 14 to 36; between these extremes the following numbers; 24, 25, 26, 27, 28, 29, 30, 31 are represented. The species having 31 chromosomes (n) are most frequent, being 35%. Those with 30 chromosomes rank second. The numerical condition found in the present study is quite similar to that in moths. Among the species concerned here, there is no evidence for the presence of polyploidy.

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CHROMOSOME NUMBERS OF JAPANESE BUTTERFLIES STUDIED BY THE AUTHORS

Species	*n* (haploid number)
HESPERIIDAE	
Daimio tethys Mén.	30 (I)*
Halpe varia Murray	31 (II)
Parnara guttata Brem. & Gray	16 (I)
PAPILIONIDAE	
Papilio xuthus Linné	30 (I)
Papilio machaon hippocrates Feld. & Feld.	31 (I)
Papilio maackii Mén.	30 (I)
Papilio protenor demetrius Cram.	30 (I)
Papilio bianor Cram.	30 (I)
PIERIDAE	
Aporia crataegi Linné	25 (I)
Anthocaris scolymus Butler	31 (I)
Colias hyale Linné	31 (I)
Eurema hecabe Linné	31 (I)
Pieris rapae Linné	26 (I, II)
Pieris napi Linné	25 (I)
Pieris melete Mén.	27, 28, ~~39~~, 30, 31 (I, II) 29/
SATYRIDAE	
Coenonympha oedippus Fab.	29 (I)
Lethe diana Butler	29 (I)
Lethe sicelis Hew.	29 (I)
Mycalesis francisca perdiccas Hew.	29 (I)
Mycalesis gotama Moore	28 (I)
Neope goschkevitschii Mén.	28 (I)
Satyrus dryas Scop.	28 (I)
Ythima argus Butler	29 (II)
LIBYTHEIDAE	
Libythea celtis Fuessl.	31 (I, II)
LYCAENIDAE	
Celastrina argiolus Linné	25 (II)
Neozephyrus taxila Bremer	24 (I)
Curetis acuta paracuta Nicé.	29 (I)
Lycaena phlaeas Linné	24 (I, II)
Zizeeria maha argia Mén.	24 (I)
Everes argiades Pallas	24 (I)
Arhopala japonica Murray	24 (I)
NYMPHALIDAE	
Argynnis charlotta	29 (I, II)
Argynnis laodice Pallas	31 (I)
Argynnis ruslana Motsch.	26 (I)
Argynnis paphia Linné	29 (I)
Argynnis anadyomene Felder	36 (I)
Aglais urticae Linné	31 (I)
Apatura ilia Schiff.	31 (I)
Araschnia burejana Brem.	31 (II)
Araschnia levana Linné	31 (I)
Brenthis ino Rott.	14 (I)
Hestina japonica Feld. & Feld.	30 (I)

* (I) denotes the first spermatocyte and (II) the second spermatocyte.

Kaniska canace Linné	31 (I)
Limenitis camilla Schiff.	30 (I, II)
Limenitis glorifica Fruhst.	30 (I)
Neptis aceris Lep.	30 (I, II)
Nymphalis io Linné	31 (I, II)
Nymphalis xanthomelas Esper	31 (I)
Polygonia c-album Linné	31 (I)
Polygonia c-aureum Linné	31 (I)
Sasakia charonda Hew.	29 (I, II)
Vanessa indica Herbst	31 (I, II)

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THE EXCELSIOR COMPLEX

by NICHOLAS SHOUMATOFF

In view of the variety of interesting hypotheses offered recently to explain the phenomenon of acrophilia in butterflies — their habit of sometimes lingering on hilltops — it may be helpful to recapitulate, and at the same time offer a simpler classification of alternatives, as follows:

Specific Cause	*General Type*	*Reference*
Search for foodplant	Biological	Merritt, *Lepid. News* 6:101
Emergence on hilltop	"	Arnhold, *Lepid. News* 6:99
Search for females	"	" " " "
Wind	Involuntary	Merritt, *Lepid. News* 6:101
Tropism	Element of Play	" " " "
Gregariousnness	" " "	" " " "
Liking hilltops	" " "	" " " "
Social ambition	Competition	Rawson, *Lepid. News* 5:70
Male battleground	"	" " " "

In analyzing this problem, I believe it is important to distinguish between the influences of macro- and microtopology. The former involves the well known phenomena of isolation of Lepidoptera on mountain tops due to vertical temperature gradient or geological history. I assume it is only the question of small, local hilltops that is at issue here.